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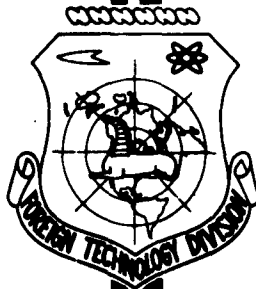
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TRANSLATION

CERTAIN SCIENTIFIC PROBLEMS IN THE FIELD OF THE CHEMISTRY
AND TECHNOLOGY OF REFRACTORIES

AUTHOR NOT GIVEN

FOREIGN TECHNOLOGY DIVISION

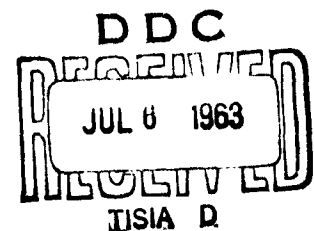


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AUTHOR NOT GIVEN

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CERTAIN SCIENTIFIC PROBLEMS IN THE FIELD OF THE
CHEMISTRY AND TECHNOLOGY OF REFRACTORIES

At the conferences held at the D. I. Mendeleev All-Union Chemical Society, at its Ukraine branch, and at the meeting of the All-Union Refractories Division of the Scientific and Technical Society of Ferrous Metallurgy at Podol'sk, P. P. Budnikov, Vice Chairman of the Chemical Society, Corresponding Member of the USSR Academy Sciences, and academician of the Ukraine Academy of Sciences, gave a report on "Scientific problems in the Field of the Chemistry and Technology of Silicates in the Light of the Resolutions of the 22nd Congress of the CPSU."

Citing data concerning previous growth of various branches of industry, the reporter especially dwelled on the role of science which has been called upon to provide the most rapid realization of the grandiose tasks set up by the program of the CPSU.

Because of the tremendous growth of metallurgy, power engineering, chemistry, the cement, glass and other branches of industry, and also because of the intensification of industrial heat processes, it is not only necessary to increase the volume of production of refractories but also to increase substantially their working properties, and also

to increase significantly the output of refractories with a melting point of 2000-3000° in order to meet the requirements for the production of new metals and alloys.

There are significant possibilities for synthesis of high-refractory materials, for example, in the large group of compounds of the type MeR_2O_4 . Such compounds are far from completely encompassed by synthesis, including the spinellides which consist of rare-earth oxides.

Investigations of spinellides are not only of theoretical interest, but they can appreciably help to improve refractory properties and to uncover the possibility of obtaining new types of compounds, answering the growing demands of engineering.

Chemically pure oxides Al_2O_3 , BeO , ZrO_2 , ThO_2 , MgO , CaO , UO_2 , CeO_2 and certain others can satisfy these demands.

Materials with a melting point of from 2000 to 4000° are needed in ever greater quantities. This pertains to such materials as carbides, nitrates, borides, silicides of transition metals of the III (lanthanum) IV, V, and VI groups of the periodic table.

The reporter emphasized the need for further investigation of the mechanics and kinetics of sintering refractory materials since these questions are still inadequately studied; it is important to study the influence on sintering of various factors under various conditions and the problems associated with controlling the sintering process. Particular attention should be paid to the investigation of the mechanism of the transfer of matter during sintering.

A study of the physicommechanical properties of oxides and especially the growth of single crystals at high temperatures, in addition to the applied value, is also of scientific value for specialists

in the chemistry of silicates and for chemists, physicists and metallurgists.

The study of the growth of crystals of perfect and imperfect structure by studying dislocation will contribute to the understanding of the nature of matter and the establishment of a more accurate theory of crystal growth. Investigations should be carried out on single crystals of oxides. For this we must develop a method of growing single crystals of BeO , MgO , SiO_2 and other oxides.

Special attention was devoted in the reports to questions of improving the working properties of refractories needed to line the sintering zone of modern, highly efficient rotary kiln for calcination of cement brick, to heat-resistant magnesite refractories with a spinel binder, to magnesite-chromite, to stabilized dolomite and dolomite-chromite refractories, and also to the shape and size of brick and to the method of laying it.

The reporter pointed out that refractory and high-refractory concrete made from Portland cement, from aluminous and other cements with a filler of ground fire clay, chromite, chrome-magnesite, stabilized dolomite, etc. should be of great value for the construction and repair of industrial heating units.

Refractory concrete and substances should be widely used for preparing heavy-duty panels and blocks, and also as gunite substances.

It is necessary to conduct further wide-scale investigations toward increasing refractory properties and the thermal and chemical resistance of refractory concretes with regard to their service conditions.

The use of barium aluminous cement as a binder in refractory concrete significantly increases the refractoriness of cements, their

thermostability, and high-temperature strength. Considering that barium cements have good shielding properties against γ - and x- radiation, it is expedient to use them in assemblies exposed simultaneously to the effects of high temperature and radiation.

The reports devoted considerable attention to the question of the further study and increase of the production of heat-resistant materials made from cordierite ($2\text{MgO} \cdot 2\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$). Because of the small sintering range of these materials, we must study the possibilities of introducing lithium-containing compounds $\text{LiAl}[\text{Si}_2\text{O}_6]$ or of other agents into cordierite ceramic body when developing a certain regime for firing the articles.

Investigations must be carried out to expand the sintering range and the formation of stable crystalline phases; we must study the processes taking place in the ceramic bodies during firing and the dependence of these reactions on production factors — the chemical and granulometric composition of mixtures, the crystalline structure and properties of the grain surfaces of the reacting substances, the composition of gas medium, and the regime of firing the materials.

Such investigations will enable us to explain and sometimes predict the effect of various factors on the course of reactions in crystalline mixtures.

Speaking on the production of different types of glass, the reporter pointed out that to intensify glass melting it is necessary to improve significantly the quality of refractories for glass furnaces. The researchers are faced with the problem of creating such refractories which would allow a minimum of glass substance diffusion. An increase in stability of refractories is important for obtaining especially responsible types of glass.

Further research into high-refractory materials is necessary not only in the systems $\text{Al}_2\text{O}_3 - \text{SiO}_2 - \text{ZrO}_2$, $\text{Al}_2\text{O}_3 - \text{BeO} - \text{SiO}_2$, $\text{Al}_2\text{O}_3 - \text{MgO} - \text{ZrO}_2$, $\text{BeO} - \text{ZrO}_2 - \text{GeO}_2$, but also in others.

The reports pointed out that modern high-temperature technology poses the problem of creating newly designed coatings for metals, cermets, carbon, and other materials.

Investigations in the field of refractories are faced with the following important problems:

a) further study of the physicochemical properties of refractories and their crystal structures;

b) development of effective methods of synthesizing high-refractory substances (carbides, nitrates, sulfides, borides, silicides and others) and also methods of obtaining high-refractory oxides with a high degree of purity and development of the technology of manufacturing products from them;

c) study of phase diagrams of systems having high-refractory components;

d) development of the physics and physicochemistry of poly-dispersed systems and the use of the obtained data for perfecting the technology of refractory products;

e) study of recrystallization processes and sintering of high-refractory substances;

f) development of the physical and physicochemical bases for producing super-stable crystal-ceramic and other refractory materials which retain strength at high temperatures;

g) study of the kinetics and mechanics of the wear of refractory materials during service (reactions with metals, their oxides, with slags, with gaseous media) and the search for methods to increase

the stability of refractories;

h) perfecting methods of refractory raw material enrichment;

i) perfecting the technology of producing high-refractories (chrome-magnesites, chrome-dolomites, periclase, high-aluminas, and others) in order to ensure intensification of metallurgical processes;

j) development of new express-control methods for the production and quality control of refractories.

The participation of K. D. Nekrasov, E. L. Rokhvarger, V. P. Petrov, B. V. Il'in, E. K. Keler, M. O. Yushkevich, M. I. Sybbotkin, K. E. Goryaynov, M. A. Matveyev, S. B. Rozenberg and others in the discussion of the reports indicated the great interest in, and importance of the problems touched upon in the reports.

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